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Becoming Digital: Enacting Digital Transformation in Construction Projects

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Abstract

Digital transformation is often conceptualised as an accomplished event; however, conceptualising it as something that organisations accomplish does not capture the features of the change process. In this study, we analyse digital transformation at the inter-organisational level (i.e. construction projects context) and conceptualise it as a dynamic change process that people enact. More specifically, we investigate the implementation of building information modelling (BIM) in construction projects, adopting a practice-based approach to explore the change process and how BIM is institutionalised in practice. We propose a preliminary conceptual model of the institutionalisation of BIM as a structuration process. Based on ethnographic data, our findings revealed two main characteristics of the process of institutionalising BIM in projects, i.e. path dependency and contingency upon institutional fields. Through our findings, we offer insights into both the literature and practice on how digital transformation in project-based contexts occurs in practice.

1. Introduction

Digital transformation has become a high priority agenda item for organisations and governments, as it holds a competitive advantage in many sectors, such as the construction sector, where the UK has a strong competitive edge. From an organisational perspective, existing research has conceptualised digital transformation as an accomplished event, with many researchers exploring its key features and antecedents (e.g. Hess et al., 2017; Sebastian et al., 2017; Singh & Hess, 2017). Although it is useful to understand the key dimensions of the phenomenon, conceptualising digital transformation as something that organisations accomplish does not capture the features of the change process (i.e. how digital transformation, or the change process itself, is actually accomplished).

In this study, we explore digital transformation at an inter-organisational level, in the context of construction projects, as the construction sector lags behind other sectors in terms of digitalisation. Inter-organisational arrangements such as projects are the essential form of organising in many relevant industries, and the scholarly interest in project studies is on the rise, especially among strategy and organisational theorists (Söderlund & Sydow, 2019). However, despite the burgeoning research interest in projects and their growing societal

importance and complexity, they continue to be treated as 'black boxes,' with little concern for internal processes (Söderlund & Sydow, 2019). There have been continual calls in the literature for more empirical investigations at a micro-level of analysis, as well as from a practice-based perspective, in order to better understand what occurs in projects in practice (Blomquist et al., 2010; Lalonde et al., 2012), such as in the case of digital transformation.

More specifically, we analyse the introduction of information management processes using building information modelling (BIM) in construction projects, as BIM sits at the heart of digital transformation in construction (Papadonikolaki et al., 2019). BIM is defined as the use of a shared digital representation of a built asset, and its aim is to facilitate design, construction and operation processes so as to form a reliable basis for decisions (ISO, 2019). It is also the process of creating and managing information on a construction project across the project lifecycle. We adopt a practice–theoretical framework to penetrate the 'black box' of what people actually do (Jarzabkowski et al., 2018) in the process of implementing information management practices using BIM in a project. In other words, we shift the analytic focus to 'how' digital transformation is constructed. We conceptualise the institutionalisation of BIM in construction projects as a change process that people enact (Jarzabkowski et al., 2018) and as a dynamic process to achieve digital congruence (Kane et al., 2016), which shapes and is shaped by people's actions. In other words, we conceive of BIM implementation as both a set of rules aimed at stabilising construction project reality, making work and human behaviour in projects more predictable, and as an outcome emerging from the application of these rules when people enact it, i.e., when BIM is implemented. We propose a preliminary conceptual framework that explains the process of institutionalising BIM as a structuration process.

2. Theoretical background

We draw on two core streams of research: digital transformation (and digital transformation in the construction industry), and the practice-based perspective (project-as-practice).

A great deal of academic and non-academic researchers have sought to understand aspects of digital transformation, such as the capabilities of digitally mature organisations or the elements of a successful digital transformation (Sebastian et al., 2017). However, knowing the building blocks of digital transformation, although important, does not reveal much about how organisations achieve digital transformation in practice. We extend research on digital transformation by investigating 'how' it is accomplished in practice.

Regarding digital transformation in the construction sector more specifically, much attention has been paid to the benefits of BIM because of its centrality in digital transformation in the construction sector. However, research on how to successfully implement BIM is yet to be conducted (Dowsett & Harty, 2018). We build on the existing research corpus and address calls within the BIM literature for more research on how BIM implementation unfolds in projects (Hall et al., 2018).

We also draw on studies that have adopted a practice lens (e.g. Jarzabkowski et al., 2018) to explore the change process. This perspective enables us to explore how actors work out BIM

implementation and informs theory and practice on how digital transformation is constructed in project-based contexts. There have been ongoing calls in the project management literature for more research to be conducted from a practice-based perspective (Lalonde et al., 2012; Padalkar & Gopinath, 2016). A notably under-theorised area in terms of what occurs in practice is the micro-process of change associated with the introduction of new management practices in projects (Bresnen et al., 2004; Bresnen et al., 2005), as in the case of digital transformation relating to BIM implementation.

3. Methodology

Given the nature of the research problem, we applied a qualitative method that is strongly associated with the practice turn lens (Van der Hoorn & Whitty, 2017). We employed ethnography, a commonly used method in practice-based research (Blomquist et al., 2010). There have been calls for rich ethnographic studies when investigating practices in the context of projects, aiming to understand human and managerial action in concrete project situations (Lalonde et al., 2012). We, therefore, drew on the ethnographic data of ten construction projects at different lifecycle stages by using a from-within (capturing the experience of those involved in it) and an in-the-flow (studying the phenomenon while it is being enacted) approach to capture the aspects of BIM implementation over time and across projects.

The fieldwork was carried out over ten months (2018–2019), during which time the first author was immersed in the projects. The ten projects involved new and refurbished educational facilities in three large organisation estates. Estate organisations' projects were selected through purposive sampling (Bryman & Bell, 2011). As the goal was to investigate BIM as a systemic and digital innovation and to identify project team members' actions that bring about BIM implementation over the entire asset lifecycle, we looked for BIM projects in which all stakeholders involved in the building's lifetime (e.g. clients, facilities managers) were part of the project team. The aim was to identify the roles and actions undertaken by all members when enacting BIM. The collected data include project documentation, semi-structured interviews with multiple project members, access to the organisations' intranet, meetings and workshops. Table 1 presents a summary.

Our analysis followed the principles of grounded theory, starting with a detailed analysis and progressing to greater generality (Mantere et al., 2012). It started with a fine-grained reading of the data (interviews, documentation, meeting minutes, field notes), the aim of which was to reconstruct what happened in practice. We used the NVivo software to catalogue and code the data. Our first round of coding focused on identifying descriptions that indicated what people did, who did what, how and why at each stage of the project lifecycle. We then clustered the different actions taken in different projects in the same period to identify the reasons why such actions were undertaken. We identified that the actions in the process of institutionalising BIM were contingent upon contextual circumstances. In what follows, and based on the collected data, we present the preliminary conceptual model explaining how BIM is institutionalised in projects.

Table 1 – Sources of data on learning about BIM implementation.

Source	Details
Project documentation	Employer's information requirements; asset information requirements; building information modelling (BIM) execution plan, digital handover documentation
Intranet	Common data environment; internal intranet system: direct access to archived information on the studied projects
Interviews	Semi-structured interviews with project team members: the project manager, consultants, architects, contractors, sub-contractors, BIM coordinators, facilities managers, information managers. Questions related to their experience working on a BIM project, challenges faced, actions taken, etc.
Meetings	Project team meetings, design review meetings, workshops, estate management internal meetings, informal meetings
Visits	Visits to the construction sites

4. Preliminary conceptual model

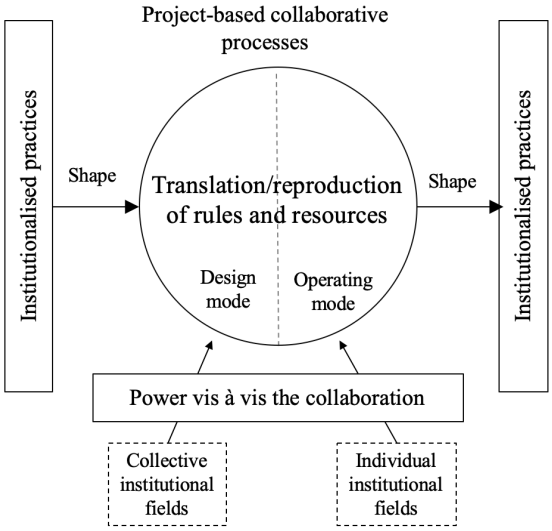
We structured our preliminary findings into a model that links the project collaborative context with the institutional fields (Phillips et al., 2000) – Figure 1. Due to space limitations, we provide just an overview of the model, which emerged from the data analysis. The model shows how BIM is implemented in practice and reveals the influence of individual and collective institutional fields in the way that the practices regarding the implementation of BIM are enacted. An institutional field is delimited by a particular distribution of institutionalised rules and resources (Phillips et al., 2000).

The implementation of BIM is mandatory for public clients in the UK. BIM standards set up the information management practices that are institutionalised at the industry level and that should be institutionalised in projects. The institutionalisation of the information management practices develops through a process of structuration, whereby patterns of social action work to reproduce the rules (Giddens, 1984) and achieve the mandated implementation. Thus, BIM serves as both the rules that guide and shape action in the collaborative context and what emerges when those rules are enacted in practice and institutionalised in the project.

The implementation of BIM or the process of enacting the institutionalised rules involves two main modes of activity (Rodriguez et al., 2007): i) a design mode, in which the dominant actor (the client), in collaboration with partners, design the requirements and ii) an implementation

mode, in which the requirements are produced by the project stakeholders. In practice, the design and operations modes of activity shade into one another, representing a path-dependent process.

Figure 1 – Structuration of BIM implementation.



Our data also revealed that the actions taken to institutionalise BIM were dependent on the institutional field of the project, i.e. the type of delivery method employed, as well as the individual institutional fields of the project team members. For example, during the production of information (implementation mode), although the design initially guided the production of information, actors enacted the production of information in different ways, depending on the specific circumstances. In project 1 of estate organisation A, the contractors suggested amendments in the information content based on the firm's experience, its power in the project (collective institutional field) and the institutional field of the client. In project 2 of estate organisation B, the information content was amended by the client based on its internal team and knowledge acquisition after working on other projects. In project 3 of estate organisation C, the information content was amended in a collaborative way through workshops with all stakeholders. Therefore, practices aimed at institutionalising BIM in the project are enacted while drawing on the project members' institutional fields (both individual and collective). Our data, therefore, revealed that practices are enacted in a path-dependent and contingent manner.

5. Contributions, limitations and future research

This study offers insights into how BIM is institutionalised in projects, how BIM implementation guidelines are translated into action and influential aspects in the way that practices are enacted. The use of a practice lens to investigate BIM as a digital transformation tool in the context of construction projects contributes to the literature on digital transformation by revealing micro-level aspects of change. It also contributes to project-management research, as there have been calls for more practice-based research from new theoretical perspectives such as structuration theory (Bresnen, 2016). The findings are limited

to the data collected thus far. However, this is an ongoing research project, and further rounds of data collection will help shed light on more nuanced aspects of institutional fields and its influence on how practices are enacted.

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